MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2018/2019

ETM3056 – MULTIMEDIA AND COMMUNICATION NETWORKS

(TE)

20 OCTOBER 2018
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 5 pages with 4 Questions only.

2. Attempt **ALL** questions. Each question carries an equal total mark and the mark distribution for each question is given.

3. Please write all your answers in the Answer Booklet provided.

Question 1

(a) Distinguish four main types of multimedia with one example each.

[8 Marks]

(b) An animation is produced via a mobile application having a size of 1 Mbytes. Describe the classes of media this animation file falls into and give two steps which can be taken to increase the resolution of the animation file whilst reducing the size of the file.

[8 Marks]

(c) A video clip is produced in a high-speed multimedia system.

(i) Formulate a general equation which calculates the size of the video clip and briefly describe the formula.

[3 Mark]

(ii) Describe three desirable features for the high-speed multimedia system to process the video clip.

[6 Marks]

Continued...

Question 2

(a) Define lossy data compression and give two examples.

[4 Marks]

(b) A song is digitally coded using pulse code modulation (PCM) with a sampling rate of 8kHz and a bit depth of 8 bits per sample in a double channel stereo playback system. The duration of the song is 7 minutes. Determine the size of this song signal in bytes.

[4 Marks]

(c) Arithmetic coding is applied to compress an image. The low and the high range values of the second last and the last symbols being compressed are (0.758,0.789) and (0.759,0.76011).

(i) What is the minimum number of bits that can be used to code these symbols?

[3 Marks]

(ii) If the compression ratio is 1.5, what is the original number of bits used to represent the symbols without any compression?

[1 Marks]

(iii) Give one advantage and one disadvantage of using arithmetic coding as compared to Huffman coding.

[4 Marks]

(d) A message ZYXZYX is to be coded using dictionary coding, where each symbol has the following probability

(i) Determine the output codes used to code the aforementioned message.

[6 Marks]

(ii) Find the compression ratio if each symbol is represented with a fixed-length binary code of 8 bits length.

[3 Marks]

Continued...

Question 3

(a) A telecommunication engineer needs to design a multimedia network system which has the following multiplexing characteristics:

1) Two T4 lines, each of which multiplexes six input lines of 5592 bits each and synchronized, bit stuffed with 720 bits.
2) Company A has reserved 150Mbps for telephony services.
3) Company B has reserved 170Mbps for telephony and data services.

(i) Determine the available amount of capacity in this multimedia network system after allocating the reserved allocation for both Company A and B.

(ii) How many voice signals of 64kps that can be supported with the remaining available amount of capacity in Question 2(a)(i)?

(iii) If a T3 line uses 69 bits for synchronization and bit stuffing, and multiplexes 789 bits from each of the seven input lines, what is the maximum number of T3 lines both Company A and B can have?

(iv) If Company B plans to allocate 15 T2 lines for data services, how many T1 lines can be allocated for Company B using the remaining capacity? [Note: A T2 line multiplexes four T1 lines and applies 17 bits for frame synchronization and bit stuffing]

[4+2+6+4 Marks]

(b) SONET and SDH offer high-speed digital transmission systems for users.

(i) Briefly describe SDH.

[2 Marks]

(ii) Give three main components of the SONET architecture and draw a general diagram of the architecture with brief description.

[7 Marks]

Continued...

Question 4

(a) Advanced LTE technology is designed to improve the achievable data rates that have been achieved by the previous technologies.

(i) Describe two techniques implemented in Advanced LTE to improve the data rates.

[2+2 Marks]

(ii) An LTE user is assigned with a 1ms subframe with 24 subcarriers, where each carrier has 100 resource elements (RE). Each RE has two timeslots and each timeslot has seven 64QAM symbols. Calculate the data rate and spectrum efficiency, assuming a unity code rate is applied on the symbols and the carrier bandwidth is 20MHz. Repeat the calculation for a 75% code rate.

[2+2+4 Marks]

(b) The Distributed Coordination Function (DCF) with RTS (Request To Send) or CTS (Clear to Send) is used to solve the hidden terminal problem. Explain how this method is applied for sending unicast packets.

[7 Marks]

(c) Orthogonal Multiple Access (OMA) and Non-Orthogonal Multiple Access (NOMA) Systems are implemented using Orthogonal Frequency Division Multiplexing (OFDM).

(i) Briefly describe OMA systems.

[2 Marks]

(ii) Describe NOMA systems and give two advantages of NOMA systems against OMA systems.

[4 Marks]

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